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Hasegawa et al.

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(54) **UPPER DIE FOR BUTTON ATTACHMENT**

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A44B 17/00 (2006.01)

(52) **U.S. Cl.**

CPC **A44B 17/0005** (2013.01); **A41H 37/04** (2013.01); **Y10T 24/36** (2015.01); **Y10T 24/3615** (2015.01); **Y10T 24/3687** (2015.01); **Y10T 24/45906** (2015.01); **Y10T 29/49915** (2015.01); **Y10T 29/49943** (2015.01)

(58) **Field of Classification Search**

None

See application file for complete search history.

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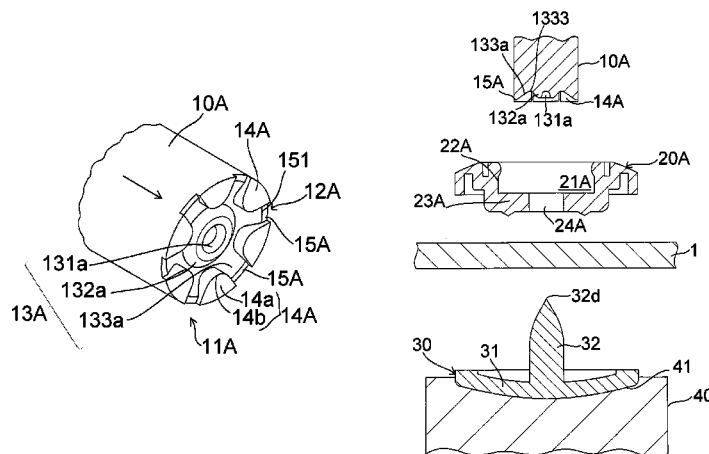
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(57) **ABSTRACT**

A button includes a button body that is placed over a first main surface of a sheet having the first main surface and a second main surface opposing to the first main surface, the button body having a hole over the first main surface; a fixing member including a base that is placed over the second main surface, and a shaft that projects from the base and passes through the hole from the second main surface towards the first main surface side, in which a distal portion of the shaft includes: a plate-like base portion provided over the button body and covering the hole; and a plurality of ribs integrally formed with the base portion and onto a surface of the base portion, and radially extending from a center to a circumference of the base portion.

6 Claims, 13 Drawing Sheets



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FIGURE 1

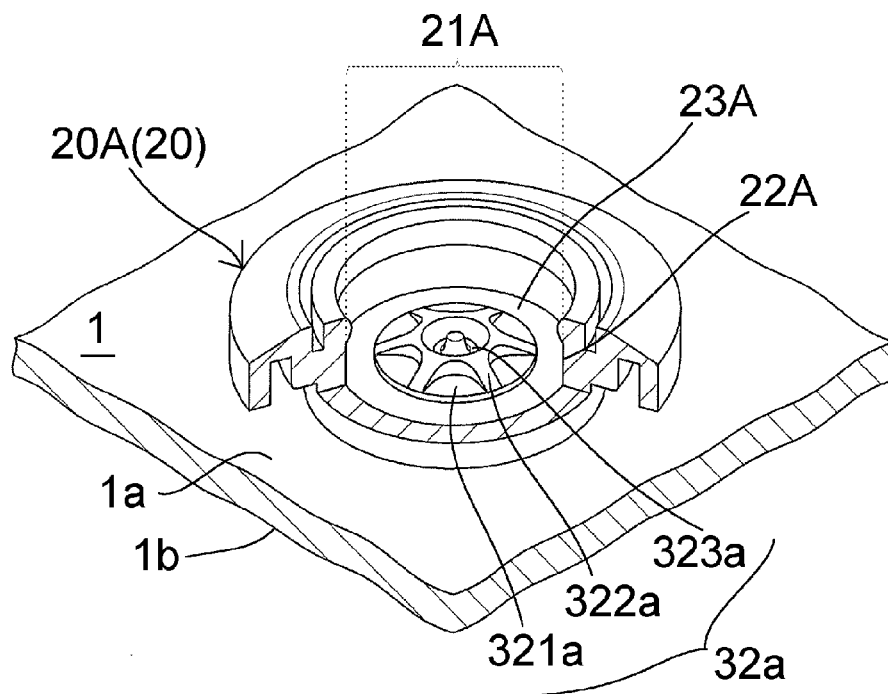


FIGURE 2

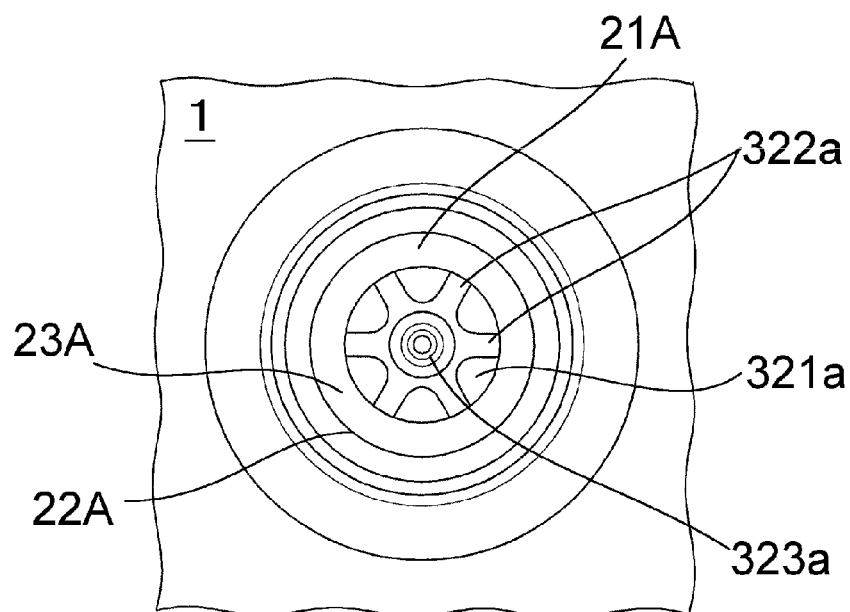


FIGURE 3

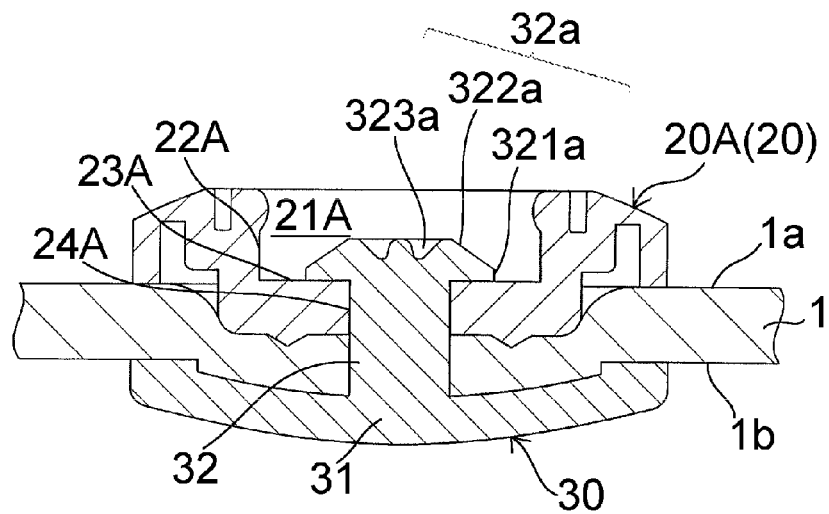


FIGURE 4

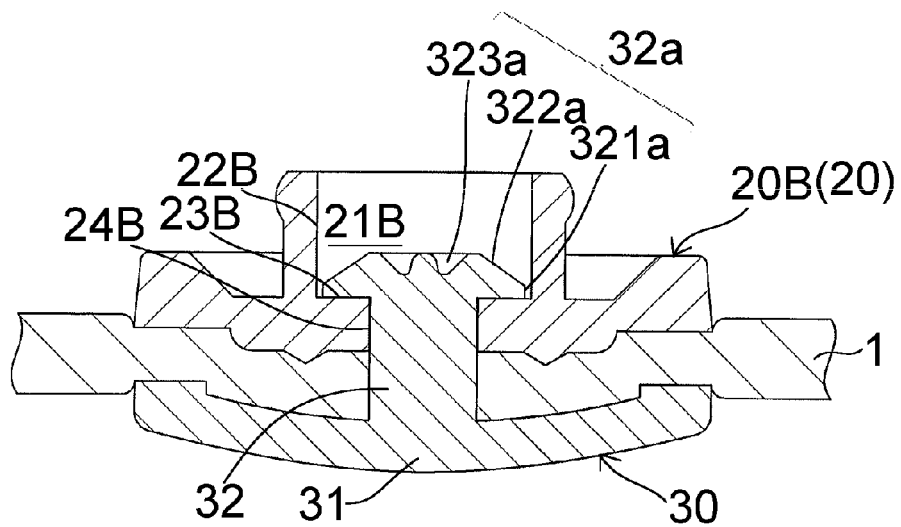


FIGURE 5

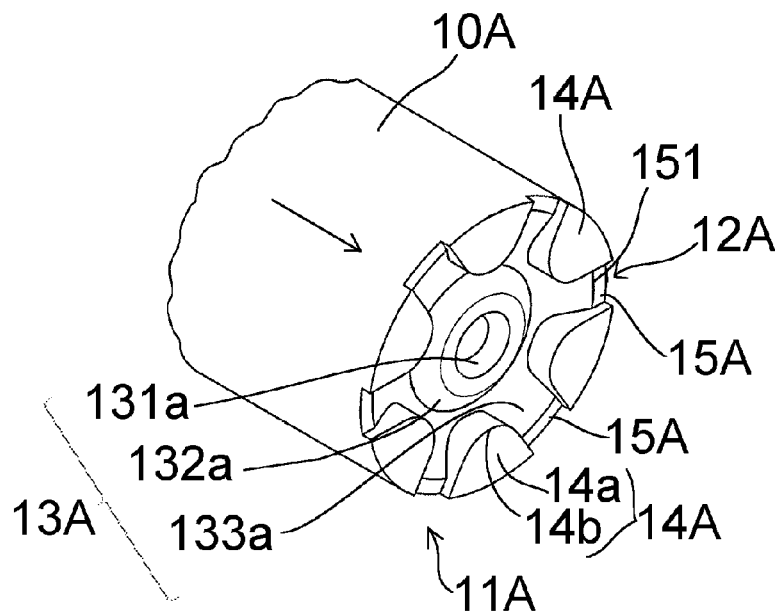


FIGURE 6

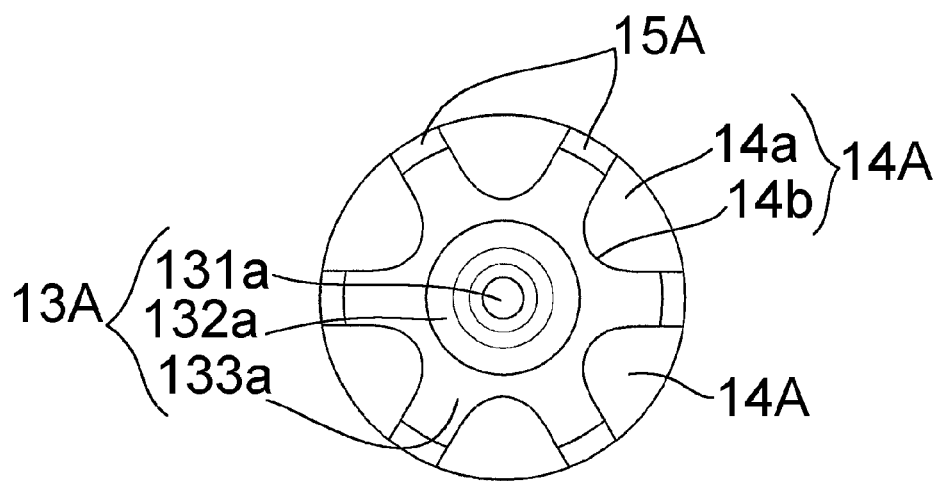


FIGURE 7

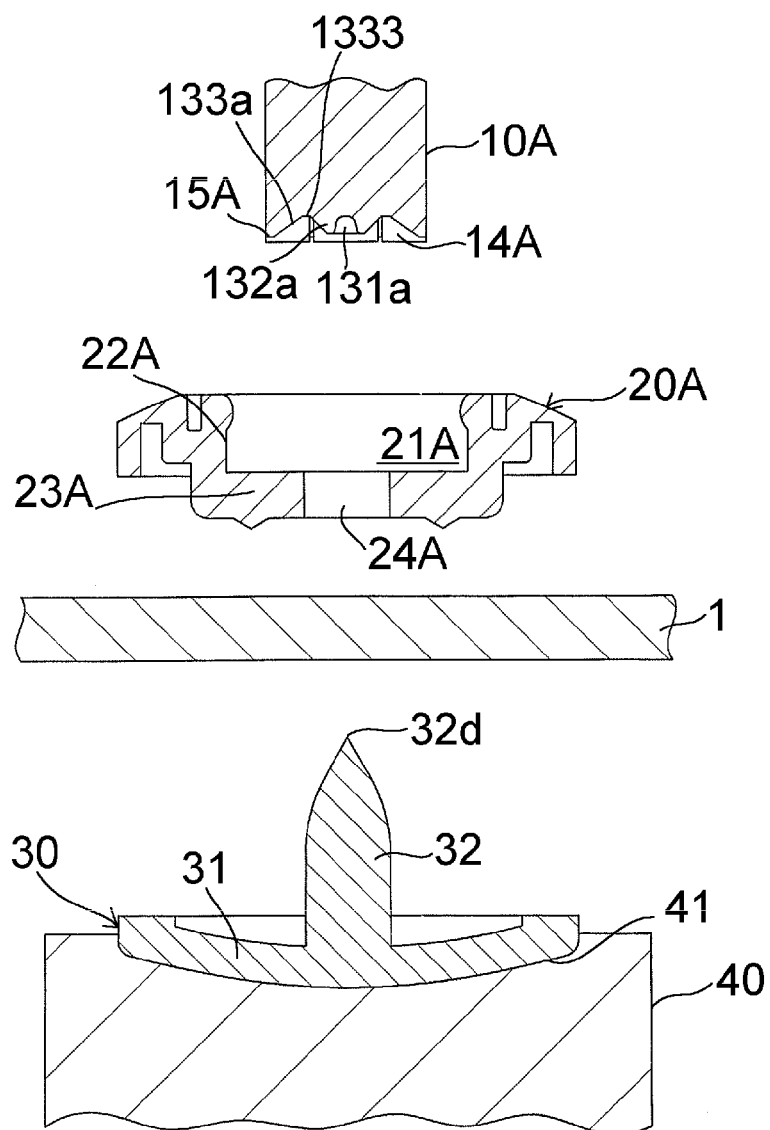


FIGURE 8

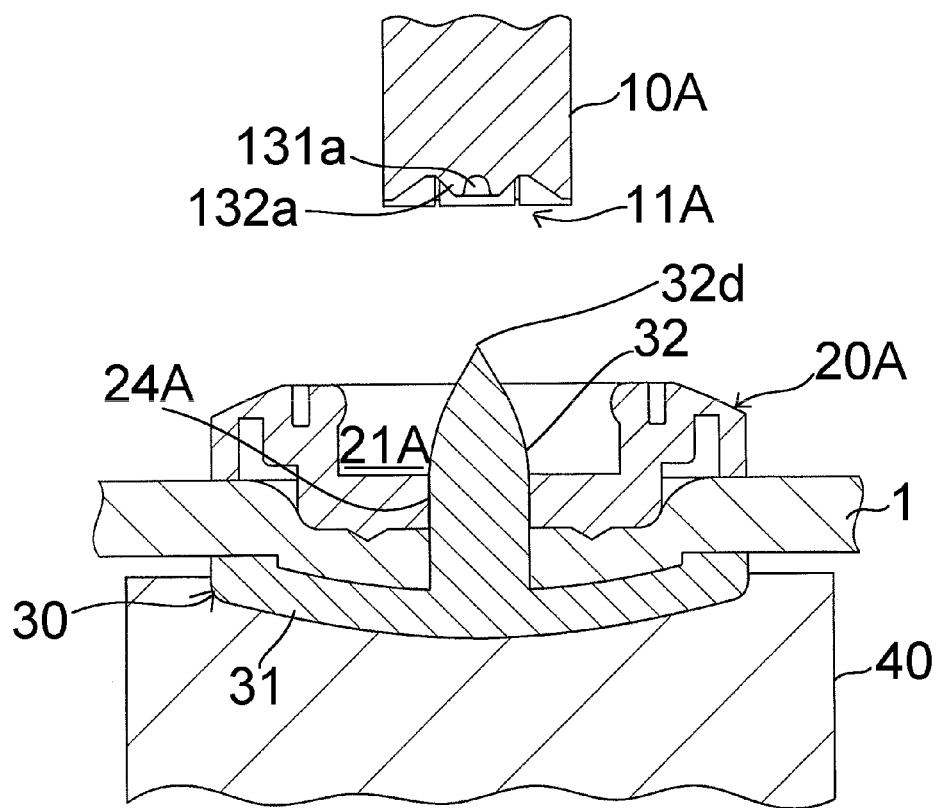


FIGURE 9

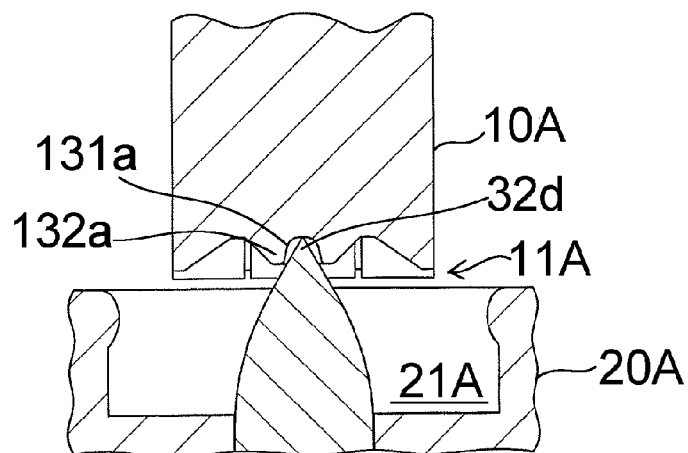


FIGURE 10

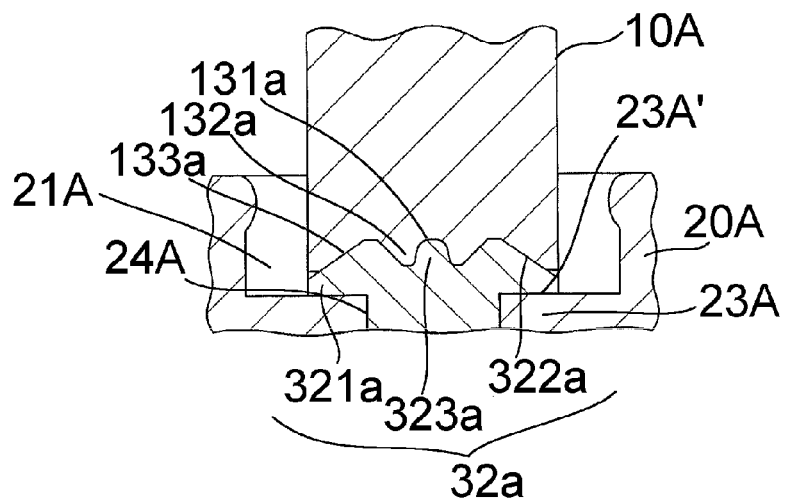


FIGURE 11

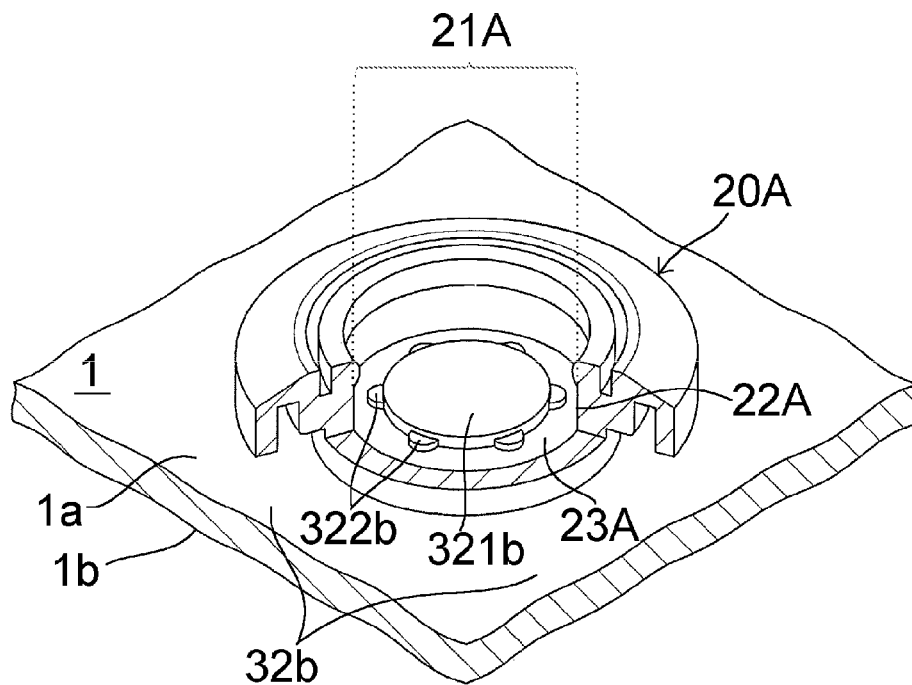


FIGURE 12

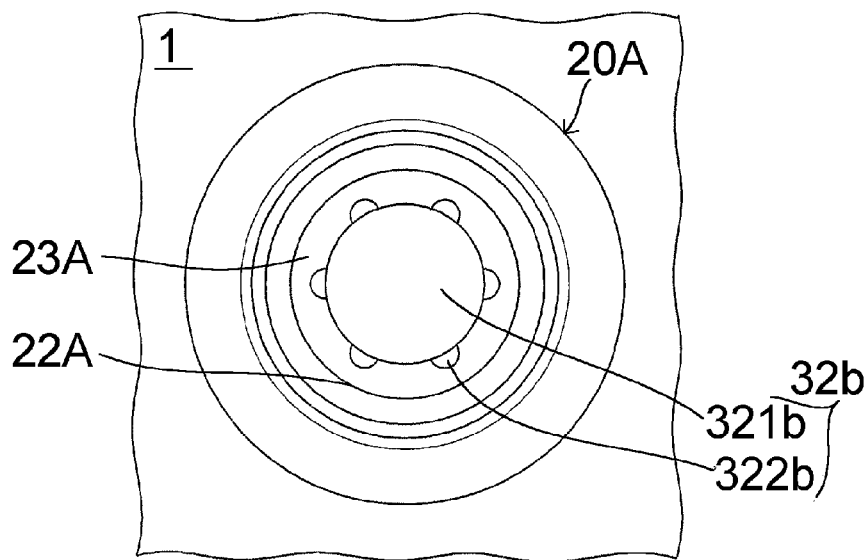


FIGURE 13

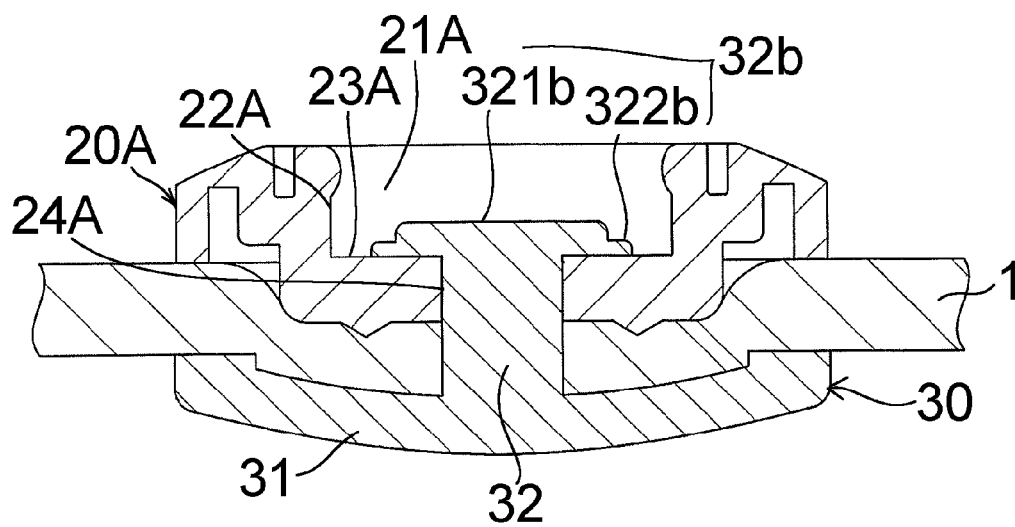


FIGURE 14

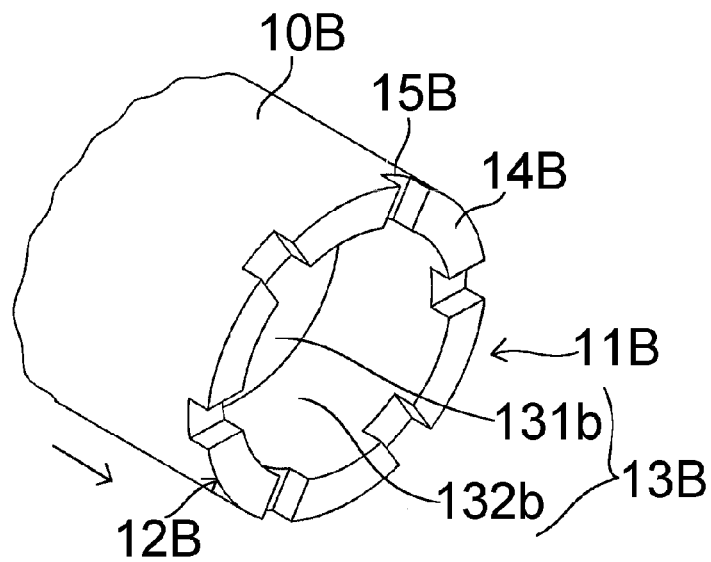


FIGURE 15

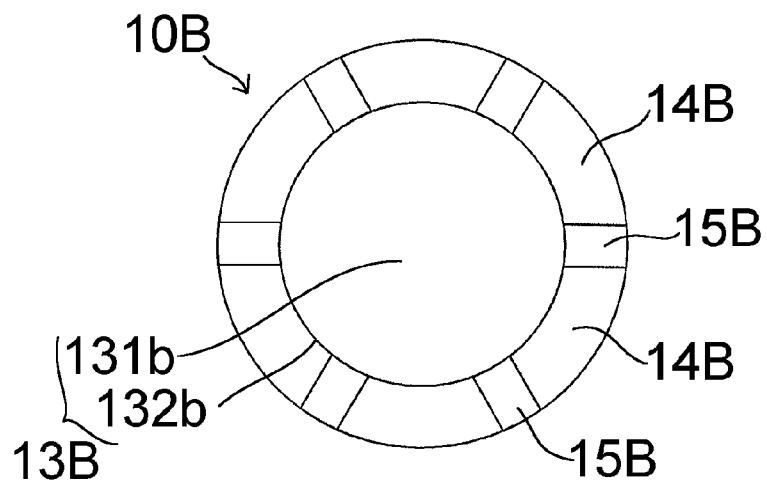


FIGURE 16

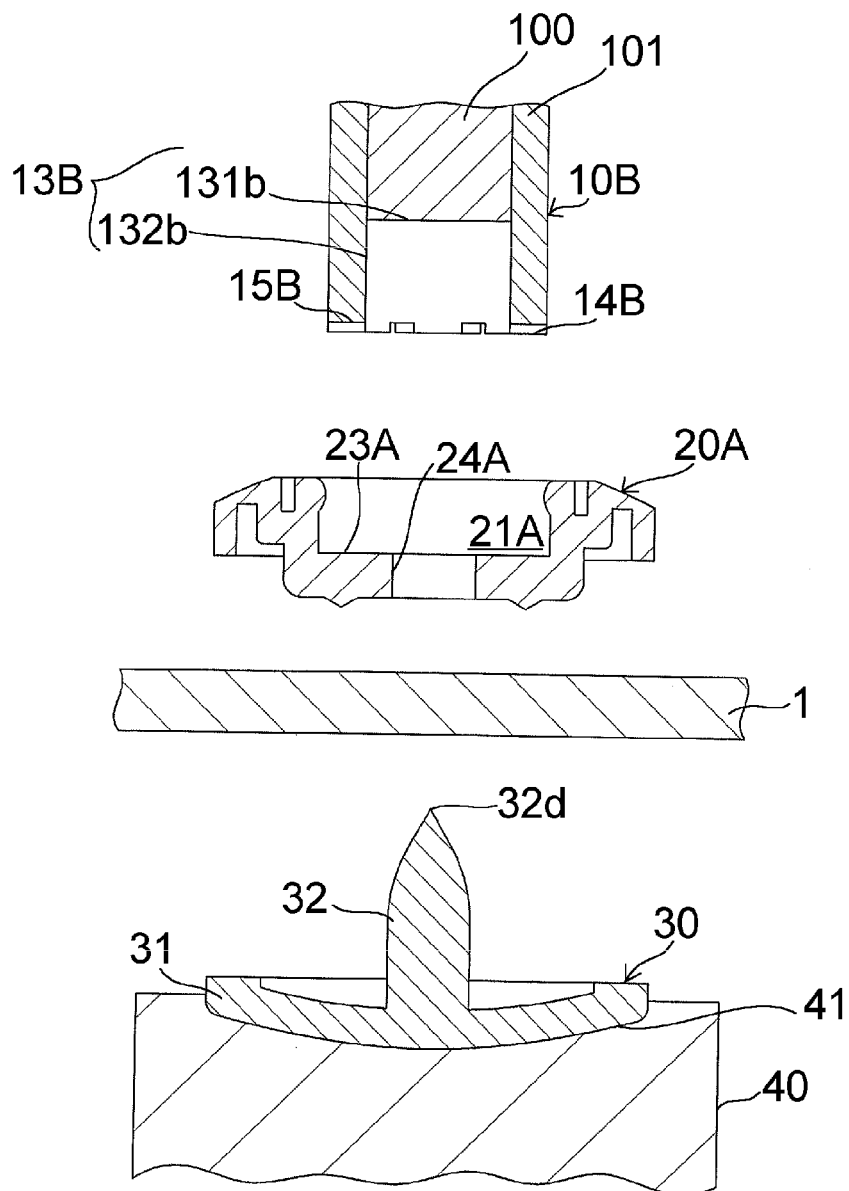


FIGURE 17

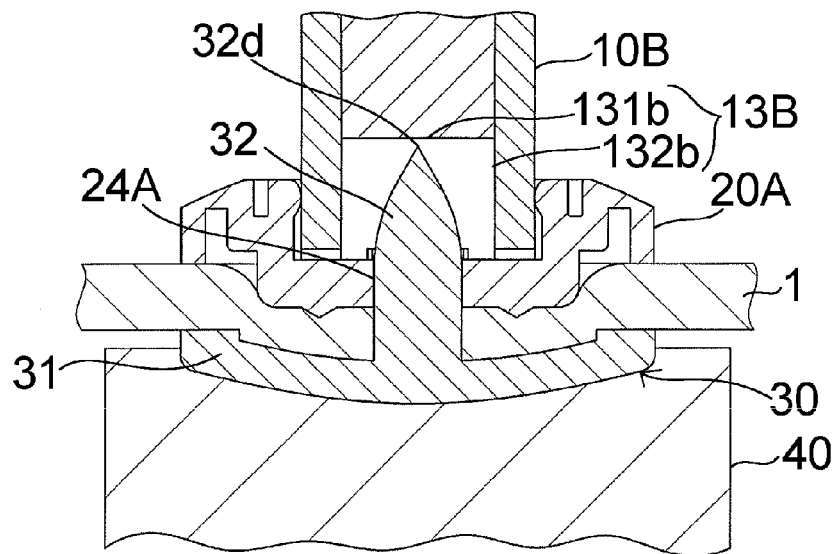


FIGURE 18

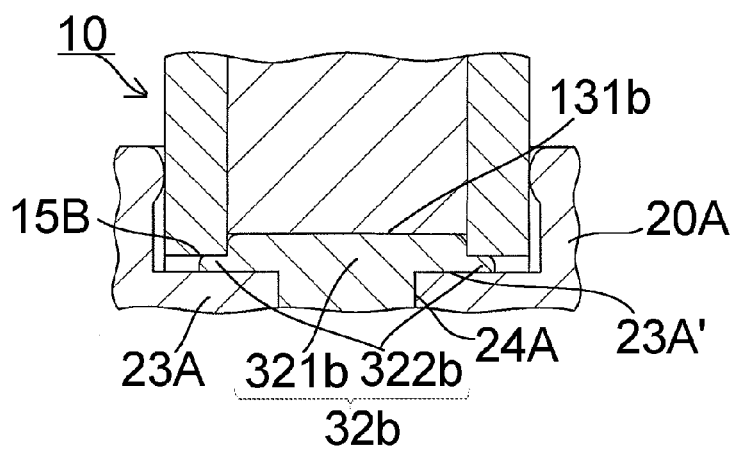


FIGURE 19

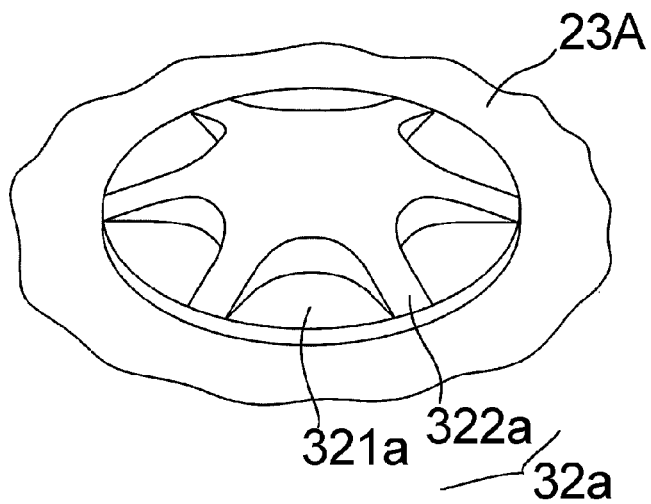


FIGURE 20

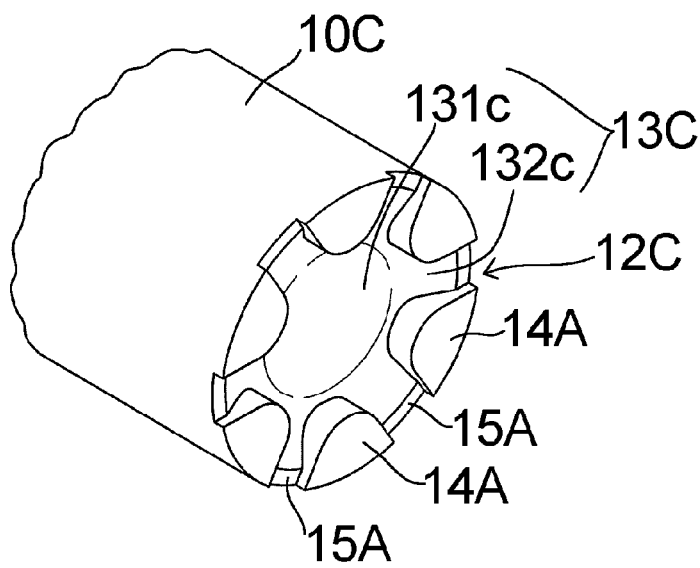
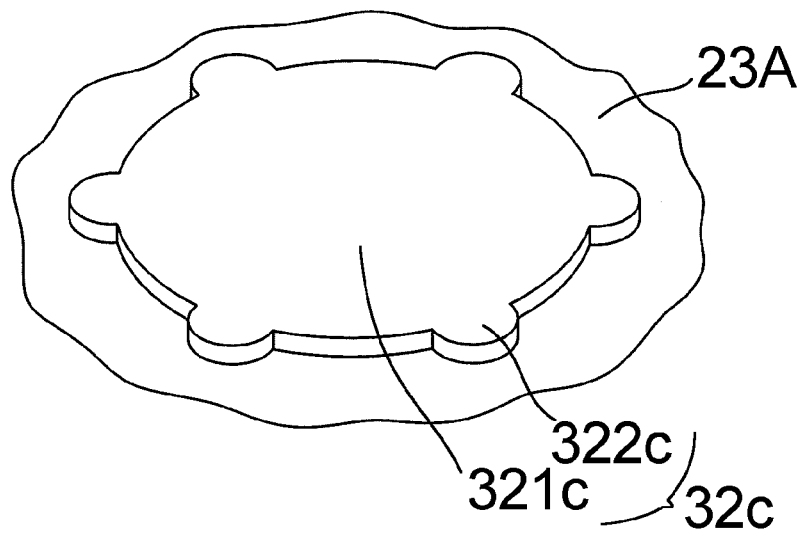


FIGURE 21



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UPPER DIE FOR BUTTON ATTACHMENT

This application is a divisional application of U.S. patent application Ser. No. 13/498,163 which is a national stage application of PCT/JP2010/061904 which claims priority to PCT Application No. PCT/JP2009/066957, all of which are incorporated herein by reference.

TECHNICAL FIELD

The subject invention relates to a button, and an upper die for button attachment.

BACKGROUND ART

When a button is attached to a cloth, generally, the button is positioned over a horizontally-arranged cloth, a button-fixing member is supported by a lower die under the cloth, and a shaft of the button-fixing member pierce the cloth. Next, after the shaft has passed through an attachment hole of the button, an upper die coupled to a pressing machine is moved down towards the lower die, thereby the shaft being swaged through press-deformation by a bottom of the upper die. Japanese Examined Patent Laid-Open No. 61-43443 and Japanese Examined Utility Model Laid-Open No. 4-2979 disclose examples of conventional upper dies.

In the conventional upper dies, however, when the shaft of the button-fixing member is press-deformed for button-attachment, the shaft is deformed to radially outwardly expand in an entire circumferential direction. Therefore, if the cloth is thick, the outward radial expansion of the shaft fails, and there may be cases where enough button attachment power and button strength are not secured. On the other hand, if the cloth is thin, there may be a case where the shaft extends radially outwardly more than required to cause a surplus portion, resulting in that formability may be degraded.

CITATION LIST**Patent Literature**

[PTL 1] Japanese Examined Patent Laid-Open No. 61-43443

[PTL 2] Japanese Examined Utility Model Laid-Open No. 4-2979

SUMMARY OF INVENTION**Technical Problem**

The subject invention provides a button with better formability where enough button attachment power and button strength are secured regardless of thickness of the cloth and so on, and an upper die for button attachment that is for producing said button.

Solution to Problem

In order to solve the above problem, one aspect of the invention provides a button including: a button body that is placed over a first main surface of a sheet having the first main surface and a second main surface opposing to the first main surface, the button body having a hole over the first main surface; and a fixing member including a base that is placed over the second main surface, and a shaft that projects from the base and passes through the hole from the second main surface towards the first main surface side, in which a distal

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portion of the shaft includes: a plate-like base portion provided over the button body and covering the hole; and a plurality of ribs integrally formed with the base portion and onto a surface of the base portion, and radially extending from a center to a circumference of the base portion.

One embodiment of a button according to the subject invention further includes a circular rib that is formed on the surface of the base portion and is integrally formed with the base portion and the rib, the circular rib being provided concentrically with an outer edge of the base portion.

Another aspect of the subject invention provides a button including: a button body that is placed over a first main surface of a sheet having the first main surface and a second main surface opposing to the first main surface, the button body having a hole over the first main surface; and a fixing member including a base placed over the second main surface, and a shaft that projects from the base and passes through the hole from the second main surface towards the first main surface side, in which a distal portion of the shaft includes: a plate-like base portion provided over the button body and covering the hole; and a plurality of ribs integrally formed with the base portion and radially projecting from an outer edge of the base portion.

In one embodiment of a button according to the subject invention, the thickness of the plurality of ribs is thinner than the thickness of the base portion.

Yet another aspect of the subject invention provides an upper die for button attachment for swaging an distal portion of a shaft that projects towards a first main surface side and passes through a hole towards the first main surface side, in which a button body with a hole is provided over the first main surface of a sheet having the first main surface and a second main surface opposing to the first main surface, and in which a fixing member having a base and a shaft projecting from the base is positioned over the second main surfaces, the upper die for button attachment including: an effect bottom that contacts with the shaft for swaging the shaft, and in which the effect bottom includes: a plurality of peripheral recesses provided on a rim that defines an outer edge of the effect bottom; an expansion allowing portion for allowing an expansion of the shaft towards an outer side in the radial direction during swage, the expansion allowing portion being provided at inner side of the rim; and a plurality of peripheral projections projecting in a longitudinal direction of the upper die for attachment than the peripheral recess at the rim, the plurality of peripheral projections being provided in a mutually separated manner in a circumferential direction of the rim.

In one embodiment of the upper die for button attachment according to the subject invention, the peripheral projection further projects towards the expansion allowing portion from the rim.

In one embodiment of the upper die for button attachment according to the subject invention, the thickness of the peripheral projection is formed to be gradually thicker towards the expansion allowing portion from the rim.

In one embodiment of the upper die for button attachment according to the subject invention, the expansion allowing portion is a recessed groove that expands towards the rim from a center of the effect bottom.

In one embodiment of the upper die for button attachment according to the subject invention, the expansion allowing portion includes: a central recess upwardly diverging at the center of the effect bottom; a circular recess upwardly diverging in a circular manner at a periphery of the central recess; a circular projection relatively downwardly diverging at an interface between the central recess and the circular recess.

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In one embodiment of the upper die for button attachment according to the subject invention, the expansion allowing portion includes: an expansion effect surface that presses the shaft during swage; and a sidewall that is provided along a circumference of the expansion effect surface.

In one embodiment of the upper die for button attachment according to the subject invention, the expansion effect surface is movable up and down along the sidewall.

Advantageous Effects of Invention

According to the subject invention, there are provided a button with better formability where enough button attachment power and button strength are secured regardless of thickness of the cloth and so on, and an upper die for button attachment to produce that button.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is a perspective cutaway view showing a button according to a first embodiment of the subject invention

FIG. 2 is a front view of the button according to the first embodiment.

FIG. 3 is a sectional view of the button according to the first embodiment.

FIG. 4 is a sectional view showing an alternative example of the button according to the first embodiment.

FIG. 5 is a perspective view showing an upper die for swaging the shaft of the button to deform according to the first embodiment.

FIG. 6 is a front view of the upper die shown in FIG. 5.

FIG. 7 is an assembling process view (No. 1) of the button according to the first embodiment.

FIG. 8 is an assembling process view (No. 2) of the button according to the first embodiment.

FIG. 9 is an assembling process view (No. 3) of the button according to the first embodiment.

FIG. 10 is an assembling process view (No. 4) of the button according to the first embodiment.

FIG. 11 is a perspective cutaway view showing a button according to a second embodiment of the subject invention.

FIG. 12 is a front view of the button according to the second embodiment.

FIG. 13 is a sectional view of the button according to the second embodiment.

FIG. 14 is a perspective view showing an upper die for swaging the shaft of the button to deform according to the second embodiment.

FIG. 15 is a front view of the upper die shown in FIG. 14.

FIG. 16 is an assembling process view (No. 1) of the button according to the second embodiment.

FIG. 17 is an assembling process view (No. 2) of the button according to the second embodiment.

FIG. 18 is an assembling process view (No. 3) of the button according to the second embodiment.

FIG. 19 is a partially expanded view of the button according to an alternative example of the first embodiment.

FIG. 20 is a perspective view of the upper die according to an alternative example of the first embodiment.

FIG. 21 is a partially expanded view of the button according to an alternative example of the second embodiment.

DESCRIPTION OF EMBODIMENTS

Hereinafter, embodiments of the subject invention will be explained with reference to drawings. In the disclosures of the drawings below, the same or like portions have been desig-

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nated by the same or like reference signs. The embodiments below exemplify the apparatus and method for embodying the technical idea of the subject invention, and the technical idea of the subject invention should not be limited to structures, arrangements, materials and so on of the components discussed below.

The First Embodiment

Button

As shown in FIGS. 1 to 3, the button according to a first embodiment of the invention has a button body 20 having a hole 24A and placed over a first main surface 1a of a sheet 1 which has the first main surface 1a and a second main surface 1b opposing to the first main surface 1a, and a fixing member 30 having a base 31 placed over the second main surface 1b and a shaft 32 that projects from the base 31 and protrudes to the first main surface 1a side after passing through the hole 24A from the second main surface 1b.

FIGS. 1 to 3 show an example where a female snap button 20A is used as the bottom body 20. The female snap button 20A includes a cylinder side 22A and a disk-like bottom 23A which define a coupling recess 21A for receiving a coupling-projection of a male snap, not shown in figure, in a removable manner. The hole 24A (See FIG. 3) extending through the bottom 23A is provided at the center of the bottom 23A, and an distal portion 32a of the shaft 32 protrudes from the hole 24A to the first main surface 1a side.

The fixing member 30 is normally made of resin, and examples of which are polyamide (PA), polyacetal (POM), polycarbonate (PC), denatured polyphenylene ether (m-PPE), polybutylene terephthalate (PBT), polyethylene terephthalate (PET), glass-fiber-reinforced polyethylene terephthalate (GF-PET), cyclic polyolefin (COP) and so on. It may be made of metal such as a brass and an aluminum alloy and so on. As shown in FIG. 7, the base 31 is shaped like a disk, and the shaft 32 before being swaged is shaped to upwardly extend from the center of the base 31 and to become thinner towards its tip.

As shown in FIG. 1, the distal portion 32a of the shaft 32 has a plate-like base portion 321a that is placed on the button body 20 to cover the hole 24A and a part of the bottom 23A, and ribs 322a that radially extends from the center to the circumference of the base portion 321a and formed integrally with the base portion 321a and onto the surface of the base portion 321a. The planar shape of the base portion 321a should not be limited, and various shapes, such as an oval, a rectangle, and a polygon may be selected. As shown in FIG. 2, the planar shape of the base 321a is formed to be circular congruently with the outer shape of the female snap button 20A, thereby buttons with superior fancy appearance being obtained. The thickness of the base portion 321a can be varied in accordance with the thickness of the sheet, which is a fixing object. As shown in FIG. 2, the ribs 322a are formed at 6 locations by 60 degree interval in the circumferential direction of the base portion 321a. The number of ribs 322a should not be limited to 6 locations and, for example it may be formed at 8 locations by 45 degree interval. Alternatively, it may be formed at 5 locations by approximately 72 degree interval. As shown in FIG. 1, the thickness of the rib 322a is formed to be gradually thinner radially outwardly from the center of the base portion 321a. At the central surface portion of the base portion 321a, there is provided a circular rib 323a that is connected to an end of the rib 322a and is provided

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concentrically with the outer edge of the base portion **321a**. The circular rib **323a** is integrally formed to the base portion **321a** and the rib **322a**.

The shape of the button body **20** should not be limited to the example shown in FIGS. 1 to 3, and other various shapes may be selected. For example, as shown in FIG. 4, the male snap button **20B** may be selected as the button body **20**. The male snap button **20B** includes a cylinder side **22B** and a disk-like bottom **23B** which define a coupling-projection **21B** to be received by a coupling recess of a female snap, not shown in figure, in a removable manner. The hole **24B** is provided at the center of the bottom **23B**, and the distal portion **32a** of the shaft **32** protrudes from the hole **24B**.

As for the sheet **1**, it should not be particularly limited insofar as it is a sheet-like member such as a thin plate of leather, paper, plastic, or rubber and so on, other than the cloth. Further, in the subject invention, the surface at a side onto which the button body **20** is attached is defined as the first main surface **1a**, and the surface at a side onto which the fixing member **30** is attached is defined as the second main surface **1b**, however, it should be appreciated that the surface at a side onto which button body **20** is attached may be the second main surface **1b** and the surface at a side onto which the fixing member **30** is attached may be the first main surface **1a**.

According to the button of the first embodiment, the ribs **322a**, which are integral with the base portion **321a**, are provided in the coupling recess **21A** of the button body **20**. The ribs **322a** are radially provided on the base portion **321a**, thereby the entire surface of the base portion **321a** being strengthened. As a result of this, it is possible to supply a button which has enough button attachment power and button strength and in which damages are suppressed even in a case where cloth thickness is thick. Further, formability and fancy appearance are improved because the ribs **322a** are radially extending on the base portion **321a**.

Upper Die for Button Attachment

As shown in FIG. 5, an upper die for button attachment **10A** (hereinafter simply referred to as an "upper die **10A**") according to the first embodiment has an effect bottom **11A** that contacts with a tip **32d** of the shaft **32** for swaging the shaft **32** (See FIG. 7). The effect bottom **11A** has peripheral recesses **15A** provided on a rim **12A** defining an outer edge of the effect bottom **11A**, an expansion allowing portion **13A** provided at inner side of the rim **12A** (central of the effect bottom **11A**), and peripheral projections **14A** provided in a mutually separated manner in the circumferential direction of the rim **12A**.

The expansion allowing portion **13A** is positioned at the inner side of the rim **12A**, and is a recessed groove (space) expanding towards the rim **12A** from the center of the effect bottom **11A**. The expansion allowing portion **13A** contacts with the tip **32d** (See FIG. 7) of the shaft **32** and receives the deformation of the tip **32d** of the shaft **32** during swage, and serves as an expansion guiding region for causing the tip **32d** of the shaft **32** to greatly expand radially outwardly. The expansion allowing portion **13A** has a central recess **131a** upwardly diverging at the center of the effect bottom **11A**, a circular recess **133a** upwardly diverging around the central recess **131a**, and a circular protrusion **132a** relatively downwardly diverging at the interface between the central recess **131a** and the circular recess **133a**.

As shown in FIG. 7, the central recess **131a** and the circular recess **133a** are both upwardly diverging in the effect bottom **11A**, and their depths are substantially equal. The cross-sectional view of the central recess **131a** is reversed U-shape, and the cross-sectional view (along one of the radius) of the

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circular recess **133a** is an obtuse isosceles triangle shape, and its apical angle is collapsed to flatten the bottom end **1333** of the circular recess **133a**. Further, the distal end of the circular protrusion **132a** is slightly rounded.

As shown in FIG. 5, the peripheral recess **15A** and the peripheral projection **14A** are alternately arranged side by side along the rim **12A** in the circumferential direction of the rim **12A**. The number of the peripheral recess **15A** and the peripheral projection **14A** should not be limited in particular. The peripheral projections **14A** are provided to protrude from the peripheral recesses **15A** in the longitudinal direction of the upper die **10A** (arrow direction shown in FIG. 5). The peripheral projections **14A** further extends from the rim **12A** towards the expansion allowing portion **13A** (the center of the effect bottom **11A**). The peripheral recess **15A** serves as a portion that allows the outward radial expansion of the shaft **32** when the shaft **32** is swaged. The peripheral projection **14A** serves as a portion that limits the outward radial expansion of the shaft **32** at the time of swage.

As shown in FIG. 6, a bottom **14a** of the peripheral protrusion **14A** has a shape (substantially triangle shape) which gradually narrows towards the center of the effect bottom **11A** in its width in the circumferential direction, and a top **14b** positioned at the center side of the effect bottom **11A** is rounded. In the example shown in FIG. 6, the bottom **14a** of the peripheral projection **14A** is provided in a horizontal plane orthogonal to the longitudinal direction of the upper die, but this should not be a ground for limitation. As shown in FIG. 5, the thickness (the length parallel to the longitudinal direction of the upper die **10A**) of the peripheral projections **14A** is formed to be gradually thicker from the rim **12A** towards the expansion allowing portion **13A** (the center of the effect bottom **11A**).

The peripheral recess **15A** is a strap-like bottom surface along the rim **12A**. This bottom surface may be a slope being inclined upwardly towards the center of the effect bottom **11A**, or may be a flat being parallel to the bottom surface of the peripheral projection **14A**.

Attachment Process

Next, an attachment process for attaching the female snap button **20A** onto the sheet **1** using the upper die for button attachment **10A** of FIG. 5 will be described. FIG. 7 shows an arrangement of the main components in an up and down direction (axial direction) just before the female snap button **20A** being attached to the cloth that is one example of the sheet **1** and, from above, the upper die for button attachment **10A**, the female snap button **20A**, the sheet **1**, the fixing member **30**, and the lower die **40** for supporting the fixing member **30** are disclosed. The lower die **40** has, on its front surface, a support recess **41** capable of receiving the base **31** of the fixing member **30**. When the fixing member **30** is placed in the support recess **41**, an axis of the shaft **32** of the fixing member is aligned with the axis of the upper die **10A**.

At an initial attachment stage in FIG. 8, the shaft **32** of the fixing member **30**, after pierced the sheet **1**, protrudes to the coupling recess **21A** side of the female snap button **20A** above after passing through the hole **24A** of the female snap button **20A**. Next, as shown in FIG. 9, the upper die **10A** is moved down (there may be a case where the lower die **40** is moved up) to receive the tip **32d** of the shaft **32** of the fixing member **30** by the central recess **131a** of the effect bottom **11A**. This allows centering being automatically performed. Following to this, the upper die **10A** is further moved down, and the circular protrusion **132a** of the effect bottom **11A** bites into the shaft **32**. Subsequent to this initial event, the effect bottom **11A** press-deforms the shaft **32** against the upper surface (bottom surface) **23A'** of the bottom **23A** of the female snap

button 20A as shown in FIG. 10, thereby the female snap button 20A being fixed onto the sheet 1. While this shaft 32 is swaged, the shaft 32 overreaches the hole 24A and expands radially outwardly on the bottom 23A' of the female snap button 20A. The outwardly expanded allowance portion is received and press-deformed by the circular recess 133a. This outward radial expansion of the shaft 32 bumps into the 6 peripheral projections 14A shown in FIG. 5, and is greatly expanded radially outwardly at the circular recess 133a and the peripheral recess 15A between the two peripheral projections 14A sitting side by side in the circumferential direction.

As shown in FIG. 5, the peripheral projections 14A are formed to be gradually thinner in its thickness from the center of the effect bottom 11A towards the rim 12A, and the top 14b is rounded as shown in FIG. 6. Owing to this, the existence of the peripheral projections 14A hardly serves to prevent the outward and radial deformation of the shaft 32. The shape of the end portion 32a of the shaft 32 matches with the shape of bumps and dips of the effect bottom 11A. Thus, the distal portion 32a of the swaged shaft is formed to have a radially-outwardly-greatly-expanded portion (rib 322a) corresponding to the recess 133a, and a less-expanded portion (not shown) corresponding to the peripheral projections 14A which are alternately arranged in the circumferential direction. Finally, its appearance is formed to be a radial shape (petal shape) with 6 ribs as shown in FIG. 1.

As such, by the attachment method using the upper die for button attachment according to the first embodiment, for example, even in a case where the sheet 1 is thick, the shaft 32 of the fixing member 30 is gathered between the peripheral projections 14A and is deformed radially and outwardly to a relatively great extent, and thus the required button attachment power is secured. Even in a case where the sheet 1 is thin, the outward and radial deformation of the shaft 32 is decentralized in the circumferential direction and less power is required for swage, and therefore the load of the pressing machine is prevented to be greater.

Second Embodiment

Button

The button according to a second embodiment of the subject invention, as shown in FIGS. 11 to 13, has the button body 20A having the hole 24A on the first main surface 1a and placed over the first main surface 1a of the sheet 1 that has the first main surface 1a and the second main surface 1b opposing to the first main surface 1a, and the fixing member 30 having the base 31 that is placed over the second main surface 1b and the shaft 32 that projects from the base 31 and protrudes to the first main surface 1a side after passing through the hole 24A from the second main surface 1b.

FIGS. 11 to 13 show an example where a female snap button 20A is used as the button body 20. The female snap button 20A includes the cylinder side 22A and the disk-like bottom 23A which define the coupling recess 21A for receiving a coupling-projection of a male snap in a removable manner. The hole 24A (See FIG. 16) extending through the bottom 23A is provided at the center of the bottom 23A, and the distal portion 32b (See FIG. 13) of the shaft 32 protrudes from the hole 24A to the first main surface 1a side.

The fixing member 30 is normally made of a resin, and examples of which are polyamide (PA), polyacetal (POM), polycarbonate (PC), denatured polyphenylene ether (m-PPE), polybutylene terephthalate (PBT), polyethylene terephthalate (PET), glass-fiber-reinforced polyethylene terephthalate (GF-PET), cyclic polyolefin (COP) and so on. It

may be made of metal such as a brass and an aluminum alloy and so on. As shown in FIG. 16, the base 31 is shaped like a disk, and the shaft 32 before being swaged is shaped to extend upwardly from the center of the base 31 and to become narrower towards its tip.

As shown in FIG. 11, the distal portion 32b of the shaft 32 has a plate-like base portion 321b that is placed on the button body 20 to cover the hole 24A (not shown in Figure) and a part of the bottom 23A, and ribs 322a that radially project from an outer edge of the base portion 321a and are integrally formed to the base portion 321a at the outer edge of the base portion 321b. The planar shape of the base portion 321b should not be limited in particular, and various shapes, such as an oval, a rectangle, and a polygon may be selected. As shown in FIG. 12, the shape of the base portion 321b is formed to be circular, thereby buttons with superior fancy appearance being obtained. The thickness of the base portion 321a can be varied in accordance with the thickness of the sheet which is a fixing object. The ribs 322b have a semi-circular or semi-oval shape as of its planar shape, and are respectively formed at 6 locations by 60 degree interval in the circumferential direction at the outer edge of the base portion 321b. The number of ribs 322b should not be limited to 6 locations and, for example, it may be formed at 8 locations by 45 degree interval. Alternatively, it may be formed at 5 locations by approximately 72 degree interval. The rib 322b is formed to be thinner than the base portion 321b in its thickness (sheet thickness direction). Although not illustrated in figures, it should be appreciated that the male snap button may be selected as the button body 20 in replace to the female snap button 20A. The sheet 1 should not be particularly limited insofar as it is a sheet-like member such as a thin plate of leather, paper, plastic, or rubber and so on, other than the cloth.

According to the button of the second embodiment, substantially planar plate-like base portion 321b and the ribs 322b being integral with the base portion 321b are provided in the coupling recess 21A of the button body 20. The button body and the fixing member 30 are closely fixed by the base portion 321b and ribs 322b, and therefore, even in a case where the cloth thickness is thick, damages are suppressed and a button having enough button attachment power and button strength may be obtained. Furthermore, formability may be improved, and fancy appearance may improve.

Upper Die for Button Attachment

As shown in FIG. 14, an upper die for button attachment 10B according to the second embodiment (hereinafter simply referred to as an "upper die 10B") has an effect bottom 11B that contacts with a tip 32d (See FIG. 16) of the shaft 32 for swaging the shaft 32. The effect bottom 11B has peripheral protrusions 14B provided along the rim 12B defining an outer edge of the effect bottom 11B, peripheral recesses 15B respectively provided along the rim 12B in a mutually separated manner, and expansion allowing portion 13B that allows the outward radial expansion of the shaft 32 and is provided at inner side of the rim 12B (central of the effect bottom 11B).

The expansion allowing portion 13B is positioned at inner side of the rim 12B, and is a recessed groove (space) extending towards the rim 12B from the center of the effect bottom 11B. The expansion allowing portion 13B serves as an expansion guiding region for causing the shaft 32 to greatly expand radially outwardly. The expansion allowing portion 13B has an expansion effect surface 131b that is a flat press-surface for contacting with the shaft 32 and a sidewall 132b formed along the circumference of the expansion effect surface 131b. In the example shown in FIG. 16, the upper die 10B is configured by a pillar-like member 100 provided at the center and a tube-like

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member **101** that accommodates the member **100** in its inside. In this case, the bottom surface of the member **100** is an expansion effect surface **131b**, and the inner sidewall of the member **101** is the sidewall **132b**. The expansion effect surface **131b** is movable in up and down along the sidewall **132b**. For example, the expansion effect surface **131b** is placed at deeper position than the bottom surface of the peripheral recess **15B** as shown in FIG. **14** before swage. At the moment of swage, the expansion effect surface **131b** moves along the sidewall **132b** to be closer to the bottom surface of the peripheral recess **15B** (See FIG. **18**) in order to contact with and deform the shaft **32**.

As shown in FIG. **14**, the peripheral recess **15B** and the peripheral protrusion **14B** are arranged alternately in the circumferential direction of the rim **12B**. The peripheral protrusion **14B** is arranged to project in the longitudinal direction of the upper die **10B** (arrow direction) than the peripheral recess **15B**. The peripheral recess **15B** serves as a portion that allows the outward radial expansion of the shaft **32** when the shaft **32** is swaged. The peripheral protrusion **14B** serves as a portion that restricts the outward radial expansion of the shaft **32** during swage.

As shown in FIG. **15**, the peripheral recesses **15B** are a strap-like bottom surfaces along the rim **12B**. This bottom surface may be a slope being inclined upwardly towards the center of the effect bottom **11B**, or may be a flat being parallel to the bottom surface of the peripheral protrusions **14B**. The peripheral recesses **15B** are formed at 6 locations by 60 degree interval in the circumferential direction of the upper die **10B** of a tubular or column-like shape. The number of the peripheral recesses **15B** should not be limited to 6 locations and, for example, it may be formed at 8 locations by 45 degree interval. Alternatively, it may be formed at 5 locations by approximately 72 degree interval.

Attachment Process

Next, the attachment process for attaching the female snap button **20A** to the sheet **1** using the upper die for button attachment **10B** of FIG. **14** will be described. FIG. **16** shows an arrangement view of the main components in up and down direction (axial direction) just before the female snap button **20A** being attached to the cloth that is one example of the sheet **1** and, from above, the upper die for button attachment **10B**, the female snap button **20A**, the sheet **1**, the fixing member **30**, and the lower die **40** for supporting the fixing member **30** are disclosed. The lower die **40** has, on its front surface, a support recess **41** that is capable to receive the base **31** of the fixing member **30**; and when the fixing member **30** is placed in the support recess **41**, an axis of the shaft **32** of the fixing member is aligned with the axis of the upper die **10B**.

At an initial stage of attachment, the shaft **32** of the fixing member **30**, after pierced the sheet **1**, protrudes to the side of the coupling recess **21A** of the female snap button **20A** above after passing through the hole **24A** of the female snap button **20A**. Next, as shown in FIG. **17**, the upper die **10A** is moved down (there may be a case where the lower die **40** is moved up) to accommodate the shaft **32** of the fixing member **30** by the expansion allowance portion **13B** of the effect bottom **11B**. From here, the upper die **10A** is further moved down (alternatively the expansion effect surface **131b** is moved down along the sidewall **132b**) resulting in that the distal portion **32b** of the shaft **32** is press-deformed by the expansion effect surface **131b** as shown in FIG. **18**. Accordingly, the shaft **32** is expanded radially outwardly above the hole **24A** over the bottom surface **23A'** of the bottom portion **23A** of the female snap button **20A**. A portion of this outwardly expanded allowance portion is press-deformed while it is received by the peripheral recess **15B**, and therefore rib **322b**

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is formed inside of the peripheral recess **15B** and the female snap button **20A** is fixed onto the sheet **1**. By the attachment method using the upper die for button attachment according to the second embodiment, even in a case where the sheet **1** is thick, the shaft **32** of the fixing member **30** is gathered at the expansion allowing portion **13B** and is deformed relatively greatly towards the outer side in deformation direction to allow its remaining portion to expand towards the peripheral recess **15B**, and thus the required button attachment power is secured. Even in a case where the sheet **1** is thin, the outward and radial deformation of the shaft **32** is decentralized in the circumferential direction, less power is required for swage, and thus the load of the pressing machine is prevented to be greater.

Other Embodiments

Embodiments of the subject invention have been explained as above, however the descriptions and drawings partially consisting this disclosure should not be interpreted to limit the subject invention. For example, a brim **151** defining the border between the peripheral recess **15A** and the expansion allowing portion **13A** is provided between the peripheral recess **15A** and the expansion allowing portion **13A** of the upper die **10A** shown in FIG. **5**, but this should not be a ground for limitation. For example, the strap-like bottom surface shown in FIG. **5** may be formed to be a slope shape gradually inclined upwardly towards the expansion allowing portion **13A**, and the end of the strap-like bottom portion may be formed integrally and continuously with the circular recess **133a** without the formation of the rim **151**.

The circular rib **323a** shown in FIG. **1** may be omitted. That is, as shown in FIG. **19**, the button may be configured by a plate-like base portion **321a** that is formed by a rise of the central portion, is positioned on the button body **20** (not shown in figure), and covers the hole **24** (not shown in Figure) and a portion of the bottom **23A**, and ribs **322a** being formed integrally with the base portion **321a** and onto a surface of the base portion **321a** and extending radially from the center to the circumference of the base portion **321a**. The outer end of the rib **322a** is not necessarily positioned on the outer edge of the base portion **321a**, and the external end of the rib **322a** may be positioned at an inner side than the outer edge of the base portion **321a**.

The central recess **131a**, circular protrusion **132a**, and circular recess **133a** may be omitted. That is, as shown in FIG. **20**, the expansion allowing portion **13C** may be formed from the expansion effect surface **131c** that is a press-surface for pressing the tip **32d** of the shaft **32** at the time of swage, and the expansion peripheral surface **132c** that is positioned around the expansion effect surface **131c**. In this case, the expansion effect surface **131c** may be curved-surface or flat-surface. The expansion peripheral surface **132c** may be curved surface or sloped surface expanding upwardly from the expansion effect surface **131c** towards a rim **12C**.

In the example shown in FIG. **11**, the rib **322b** of the distal portion **32b** of the shaft **32** is formed to be thinner than the base portion **321b** in its thickness (sheet thickness direction). However, it should be appreciated that, as shown in FIG. **21**, the thickness of the rib **322c** and the base **321c** at the distal portion **32c** of the shaft **32** may be the same. Additionally, the member **100** and the member **101** shown in FIG. **16** may be formed integrally. Further, as shown in FIG. **17**, the expansion effect surface **131b** is illustrated to be perpendicular to the sidewall **132b** in figure, however, it may have a sectional reversed U-shape curved surface according to the shape of the button to be produced.

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As explained above, it should be appreciated that various embodiments which are not clearly disclosed herein would be suggested by the subject invention, and they are modified and performed without departing from the spirits thereof at the time of reduction to practice.

REFERENCE SIGNS LIST

- 1 . . . Sheet
 - 1a . . . First main surface
 - 1b . . . Second main surface
 - 10A, 10B . . . Upper die for button attachment
 - 11A, 11B . . . Effect bottom
 - 12A, 12B . . . Rim
 - 13A, 13B . . . Expansion allowing portion
 - 14A, 14B . . . Peripheral protrusion
 - 15A, 15B . . . Peripheral recess
 - 20 . . . Button body
 - 20A . . . Female snap button
 - 20B . . . Male snap button
 - 21A . . . Coupling-recess
 - 21B . . . Coupling-projection
 - 22A, 22B . . . Side
 - 23A, 23B . . . Bottom
 - 24A, 24B . . . Hole
 - 30 . . . Fixing member
 - 31 . . . Base portion
 - 32 . . . Shaft
 - 321a, 321b . . . Base portion
 - 322a, 322b . . . Rib
 - 323a . . . Circular rib
 - 40 . . . Lower die
 - 41 . . . Support recess
- The invention claimed is:
1. An upper die for swaging shaft comprising:
 - an effect bottom that includes a surface that contacts the shaft for swaging the shaft, wherein
 - the effect bottom comprises:
 - a plurality of peripheral recesses provided on a rim that defines an outer edge of the effect bottom;
 - an expansion allowing portion configured to allow a radial and outward expansion of the shaft, the expansion allowing portion being recessed relative to the rim; and
 - a plurality of peripheral projections provided along a circumferential direction of the rim, each peripheral projection projecting in a longitudinal direction of the upper die relative to the peripheral recesses, wherein

the expansion allowing portion comprises a plurality of sloped bottom surfaces, each sloped bottom surface

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positioned between adjacent peripheral projections, and each sloped bottom surface extending radially outwardly towards the rim such that a thickness of each peripheral projection gradually decreases towards the rim.

2. The upper die according to claim 1, wherein each peripheral projection extends radially inward toward a center of the expansion allowing portion from the rim.
3. The upper die according to claim 1, wherein the thickness of each peripheral projection gradually increases towards a center of the expansion allowing portion from the rim.
4. An upper die for swaging a shaft, comprising:
 - an effect bottom that includes a surface configured to contact the shaft for swaging the shaft, wherein
 - the effect bottom comprises:
 - a plurality of peripheral recesses provided on a rim that defines an outer edge of the effect bottom;
 - an expansion allowing portion configured to allow a radial and outward expansion of the shaft, the expansion allowing portion provided inward of the rim; and
 - a plurality of peripheral projections provided along a circumferential direction of the rim and separated from each other, each peripheral projection projecting in a longitudinal direction of the upper die relative to the peripheral recesses, wherein the expansion allowing portion is a recessed groove that expands towards the rim from a center of the effect bottom.
5. The upper die according to claim 1, wherein the expansion allowing portion comprises
 - a central recess provided at the center of the effect bottom.
6. An upper die for swaging a shaft, comprising:
 - an effect bottom that includes a surface configured to contact the shaft for swaging the shaft, wherein
 - the effect bottom comprises:
 - a plurality of peripheral recesses provided on a rim that defines an outer edge of the effect bottom;
 - an expansion allowing portion configured to allow a radial and outward expansion of the shaft, the expansion allowing portion provided inward of the rim; and
 - a plurality of peripheral projections provided along a circumferential direction of the rim and separated from each other, each peripheral projection projecting in a longitudinal direction of the upper die relative to the peripheral recesses, wherein the expansion allowing portion comprises an expansion effect surface that is movable up and down along and relative to a sidewall that accommodates the expansion effect surface.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 9,414,647 B2
APPLICATION NO. : 14/475767
DATED : August 16, 2016
INVENTOR(S) : Kenji Hasegawa et al.

Page 1 of 1

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Title page, item (63), in column 1, in "Related U. S. Application Data", line 1, delete "Continuation"
and insert -- Divisional --, therefor.

In the Specification

In column 3, line 21, after "invention" insert -- . --.

In the Claims

In column 11, line 35, in Claim 1, delete "shaft" and insert -- a shaft, --, therefor.

Signed and Sealed this
Twenty-fifth Day of October, 2016



Michelle K. Lee
Director of the United States Patent and Trademark Office